Chapter 1

Definition of orthodontics and factors influencing orthodontic treatment

Orthodontics is a specialised branch of dentistry. The name comes from two Greek words:

- *orthos*, meaning straight or proper
- *odons*, meaning teeth.

So the meaning is clear – 'straight teeth'.

Orthodontics is the study of the variations that occur in the development and growth of the structures of the face, jaws and teeth and of how they affect the occlusion of the teeth. Ideally there should be the same number of permanent teeth in each arch.

Any deviation from the norm that affects teeth alignment and the bite relationship is called a malocclusion. Most malocclusions are genetic – they are inherited (e.g. missing teeth or a protruding mandible). Other malocclusions can be caused by the patient, for example digit sucking, or by external factors such as trauma.

Orthodontic treatment can correct a malocclusion by restoring the teeth to their normal position and occlusal relationship (with surgical help if needed) so that:

- the bite is fully functioning and the patient can bite and chew properly
- oral hygiene is made easier, so helping to prevent caries and gingivitis
- the malocclusion does not cause other damage, often to soft tissues
- the patient looks better and has better self-esteem.

Orthodontic treatment in conjunction with orthognathic (maxillofacial) surgery can correct an underlying jaw discrepancy or facial asymmetry. Orthodontic planning is done in conjunction with the surgeons using clinical and radiographic assessment, with a cephalometric tracing (Figure 1.1) often analysed using a computer software program.

So orthodontists set out to:

- straighten teeth
- improve the bite
- improve the function
- improve oral hygiene (making teeth easier to clean)
- improve self-esteem of the patient.

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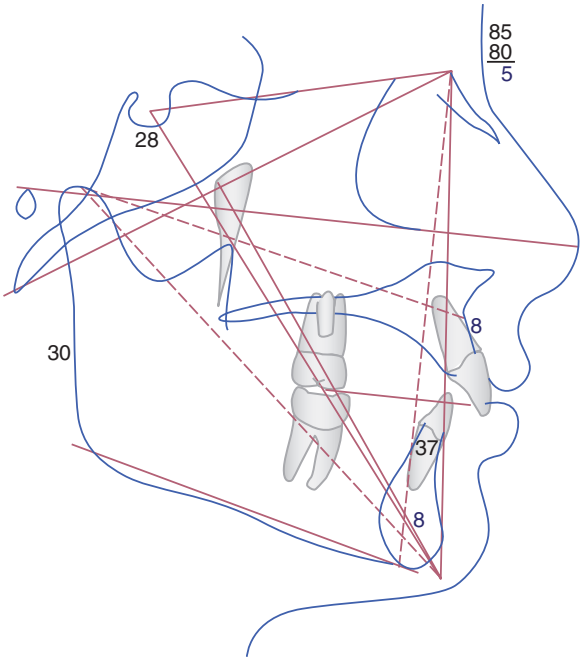

Figure 1.1 Cephalometric tracing. Source: Reproduced by kind permission of Alan Hall.

CLASSIFICATION OF OCCLUSION

When assessing occlusion there are two aspects to classification:

- incisor relationship
- buccal segment occlusion, left and right.

Both are recorded on a patient's orthodontic assessment form.

Incisor classification

- classes have Roman numerals, e.g. I, II, III.
- divisions do not, e.g. Class II/1 or Class II/2.

The incisor classification (Figure 1.2):

- relates to the bite of the tip of the lower central incisors onto the back of the upper central incisors
- it is divided into three horizontal sections and where the lower incisor occludes will determine the classification.

Class I

- the incisal edge of the lower incisors bite on or below the cingulum plateau of the upper incisors.

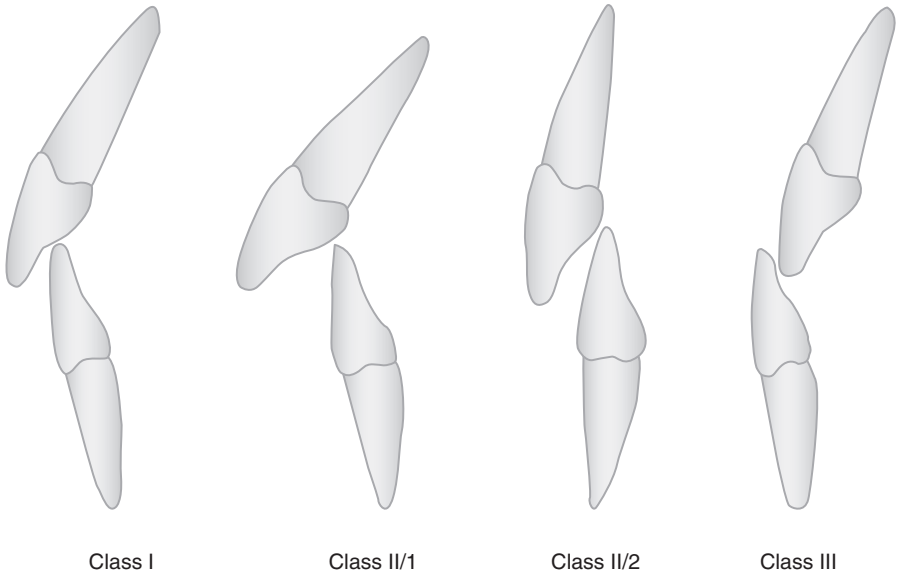

Figure 1.2 Incisor classification. Source: Reproduced by kind permission of Alan Hall.

Class II/1

- the upper incisors are proclined or upright (Figures 1.3 and 1.4).
- the lower incisors bite behind the cingulum plateau of the upper incisors.
- the position of these front teeth means they can be damaged more easily because of their vulnerable position.

Class II/2

- the upper incisors are retroclined.
- the lower incisors bite behind the cingulum plateau.
- the position of the teeth can, when closed, lead to trauma to the lower labial gingivae and the upper palatal gingivae (Figures 1.5–1.7).

Class III

- the bite is edge to edge or reversed.
- the incisal edge of the upper incisors can bite into the back (lingual) surface of the lower incisor (Figure 1.8).
- a horizontal overlap is called an **overjet**.
- a vertical overlap is called an **overbite**.

Buccal segment occlusion

The buccal segment occlusion:

- was devised by Edward Angle in 1890
- is still widely used today

Figure 1.3 Large overjet. Source: Reproduced by kind permission of Jonathan Sandler.

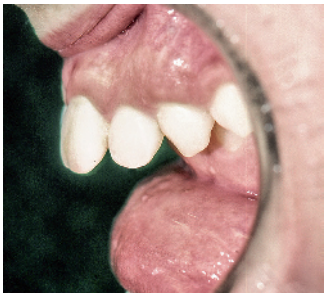

Figure 1.4 Side view of severe overjet. Source: Reproduced by kind permission of Alan Hall.

Figure 1.5 Bite stripping lower gingivae. Source: Reproduced by kind permission of Jonathan Sandler.

Figure 1.6 Damage to labial gingivae caused by the bite. Source: Reproduced by kind permission of Jonathan Sandler.

Figure 1.7 Bite causing trauma to the palate. Source: Reproduced by kind permission of Alan Hall.

Figure 1.8 Class III. Source: Reproduced by kind permission of Alan Hall.

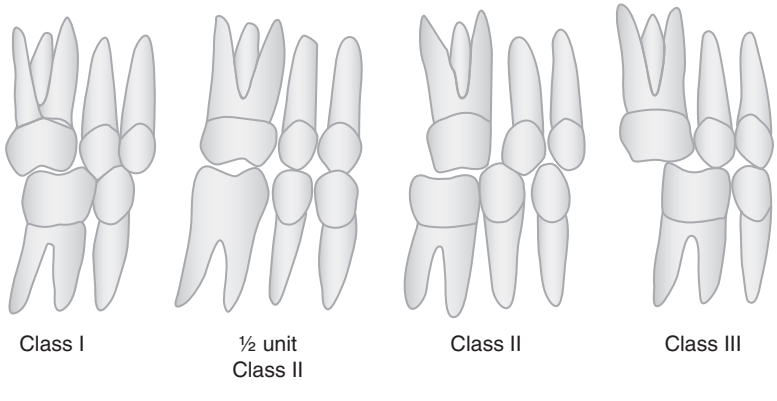

Figure 1.9 Diagram of buccal segment occlusion. Source: Reproduced by kind permission of Alan Hall.

- is based on the occlusion between the first permanent molar teeth, which erupt when the patient is about 6 years old.

There are three classes:

- **class I:** this is near to the correct relationship
- **class II:** this is at least half a cusp width behind the ideal relationship
- **class III:** this is at least half a cusp width in front of the ideal relationship (Figure 1.9).

THE MIXED DENTITION

Sometimes parents see their child's perfectly straight deciduous teeth fall out only to be replaced by a 'jumble' of crowded permanent teeth. This often prompts them to want early treatment because permanent teeth can look huge in little faces.

Hypodontia

Patients with hypodontia do not have the full complement of teeth. This can occur in the deciduous and permanent dentition. In some cases, if it is just a single tooth, it is possible to close the space orthodontically. If there are too many missing this may require a solution involving replacements such as bridges and implants, with orthodontic treatment being used to position the teeth in the correct spaces (Figure 1.10).

The average times for permanent tooth eruption are as follows.

- age 6
  - 1/1 lower central incisors
  - 6/6 lower first molars
  - 6/6 upper first molars
- age 7
  - 1/1 upper central incisors
  - 2/2 lower lateral incisors
- age 8
  - 2/2 upper lateral incisors
- age 11
  - 3/3 lower canines (cuspids)
  - 4/4 lower first premolars (bicuspids)
  - 4/4 upper first premolars (bicuspids)
- age 12
  - 3/3 upper canines (cuspids)
  - 5/5 lower second premolars (bicuspids)
  - 5/5 upper second premolars (bicuspids)
  - 7/7 upper second molars
  - 7/7 lower second molars

Figure 1.10 Hypodontia. Source: Reproduced by kind permission of Jonathan Sandler.

- age 18–25
  - 8/8 upper third molars (wisdom teeth)
  - 8/8 lower third molars (wisdom teeth).

Normally, patients begin orthodontic treatment between the ages of 10 and 13 years old. At 10–11 years they are still in the mixed dentition, with

- some deciduous teeth
- some permanent teeth
- some teeth yet to erupt.

INDICATIONS FOR TREATMENT

Clinical indications for orthodontic treatment may be because the teeth:

- are overcrowded
- may have erupted out of position
- are protruding (Class II/l)
- exhibit reverse bite
- exhibit self-damaging bite (Figure 1.11)
- are spaced
- are absent (hypodontia)
- are damaged.

Mild malocclusions, for example:

- with only very small irregularities
- where the tooth position does not compromise oral hygiene
- which do not interfere with function, such as biting off food and eating,

may not be merit orthodontic treatment, as it may not be seen to significantly improve dental health.

However, some presentations, for example:

- with overcrowded, protruding teeth
- with rotated teeth that make oral hygiene difficult and cause problems with caries
- which visually deviate from average, e.g. a reverse bite

Figure 1.11 Lower incisor trapped outside the bite.
Source: Reproduced by kind permission of Alan Hall.

Figure 1.12 Scissors bite. Source: Reproduced by kind permission of Jonathan Sandler.

- which look unattractive and affect the smile
- which seriously affect function, e.g. make chewing food difficult,

are classed as malocclusions warranting treatment.

Scissors bite

This is a lingual crossbite, where the buccal cusps of the lower premolars and molars occlude palatal to their opposing upper tooth (Figure 1.12).

UNDERLYING CAUSES OF MALOCCLUSION OF THE TEETH

There may also be:

- underlying skeletal abnormalities
- facial asymmetries.

These can be:

- hereditary (e.g. tendency to being Class III)
- a result of injury
- a result of illness affecting facial or skeletal growth
- a result of a syndrome or cleft.

These may require orthodontic treatment as part of a multidisciplinary care treatment pathway.

Multidisciplinary approach

In cases requiring a multidisciplinary approach, patients receive their orthodontic treatment in co-ordination with other specialties.

These specialties include:

- restorative (e.g. hypodontia patients requiring implants/bridges or microdontia patients needing veneers or crowns)
- surgical (e.g. patients needing an osteotomy)
- cleft (e.g. patients requiring alveolar bone grafting).

PROBLEMS WHEN THE ARCH IS NOT INTACT

One of the aims of orthodontic treatment is to have each tooth in its correct place within the dental arch.

If a tooth is malaligned (out of its correct position), it is not necessarily an isolated problem – it has a 'domino' effect. The teeth either side of it may also be out of their correct position and the opposing tooth does not have the correct occlusion.

If there is no tooth to oppose it, a tooth may supra-erupt. Contact points are lost, teeth rotate and, because they are no longer self-cleansing, food traps are created where fibres can get lodged or packed. As a consequence of this, plaque is encouraged to accumulate, which in turn:

- inflames the gingivae
- encourages periodontal pockets.

In the young patient this is not too drastic, as it probably has not yet become a significant issue.

In adult patients, however, following orthodontic treatment it may be necessary to restore incisal edges or fill cervical abrasion cavities, which only become apparent when the teeth have been corrected.

BRUXISM

- young patients, towards the end of the deciduous dentition, can often present with teeth almost ground down to gingival level. It may continue into the mixed dentition and is often quite noisy and noticeable when it occurs in sleep.
- for some older patients with severe bruxism, an occlusal guard can be made to be worn at night during sleep. This attempts to limit the damage that is done to the incisal and occlusal surfaces of the teeth.
- anxious patients also grind and clench their teeth during the day when under stress. Patients often also clench their teeth when doing weight training at the gym.

DIGIT SUCKING

Some patients continue to suck their fingers or thumbs well beyond the age when their deciduous teeth have been replaced by their permanent successors. A prolonged habit is one which exists until the age of 7 years.

It may adversely affect the bite and position of the anterior teeth and can produce:

- a unilateral buccal crossbite
- an asymmetrical anterior open bite where the finger or thumb enters the mouth (Figure 1.13)
- an increased overjet.

Figure 1.13 Anterior open bite due to digit sucking. Source: Reproduced by kind permission of Alan Hall.

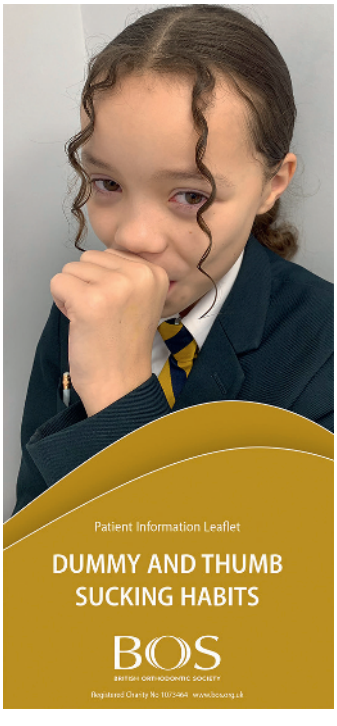

Figure 1.14 Leaflet on digit sucking. Source: Reproduced by kind permission of British Orthodontic Society.

How much damage is caused depends on how long, and how frequently, the thumb or finger is sucked and how strong the habit is (i.e. occurs not just when alone going to sleep but also during the day when tired, bored or stressed).

These patients try really hard to break this habit but sometimes they need a bit of help (Figure 1.14). It is possible to fit a removable upper anti-habit appliance, which has prongs in the centre of the palate that act as a positive deterrent for the thumb or finger. This is worn full time or only when the individual is asleep.

Once the habit is broken, the problem is often solved. However, some patients experience strong emotional comfort from digit sucking and this compulsion may need to be assessed in detail. An image of an anti-habit device is provided in Chapter 7.

DENTAL HEALTH

Some problems are caused by:

- diet (too much sugary or acidic food or drink, causing dental caries)
- tooth brushing (the wrong technique, too hard a brush)
- acid reflux (a symptom of bulimia in anorexic patients)
- medication (side effect of some medication inhalers).

Damage to teeth resulting in tooth surface loss comes under the following general headings:

- attrition: bruxism (patients who grind their teeth, often during sleep)
- abrasion: excessive wear (e.g. overenthusiastic tooth brushing)
- erosion: of the enamel by acid, found in fresh fruit juice, diet drinks and stomach acid (found in reflux)
- abfraction: a tooth being 'high on the bite' and being overloaded.

Charting of teeth is an area you all know well, and follows the standard numbering commonly used in the UK.

Permanent dentition (as the clinician looks at the patient)

Upper right	upper left
87654321	12345678
Lower right	lower left
87654321	12345678

Deciduous dentition (as the clinician looks at the patient)

edcba	abcde
edcba	abcde

There are other methods of tooth numbering, of which the World Dental Federation (FDI) and the universal numbering systems, are notable examples. Sometimes you may receive transfer cases which use an alternative method to the one you are used to, so it is good to know the alternatives.

The FDI code is one most commonly used and it uses the existing numbers but just adds an extra number:

- upper right is 1, so upper right canine would be 13
- upper left is 2, so upper left lateral would be 22

- lower left is 3, so lower left wisdom tooth would be 38
- lower right is 4, so lower right first premolar would be 44.

And in the deciduous dentition

- upper right is 5, so upper right lateral is 52
- upper left is 6, so upper left canine is 63
- lower left is 7, so lower left central 71
- lower right is 8, so first lower right molar is 84.

CONDITION OF THE SURROUNDING SOFT TISSUES

Lips

- competent: when they are at rest and come together easily and form a good oral seal.
- incompetent: when at rest do not close, or if they are closed, the lips are strained, often as a result of posturing. This closure is only temporary.

Tongue

- the tongue works with the lower lip to form a seal when swallowing.
- a tongue which tends to thrust can push forward and 'splay' the front teeth out.

The position of the teeth and the form of the dental arches are determined by the balance of the soft tissues between tongue and lips/cheek. If the tongue's free movement is restricted, when the lingual frenum is attached too far forward on the tongue, this interferes with, and restricts, function and is called a tongue tie. It can also interfere with speech, hence the expression 'to be tongue tied' (Figure 1.15).

Figure 1.15 Tongue tie. Source: Reproduced by kind permission of Jonathan Sandler.